EXPERIMENTAL BEHAVIOUR OF CONCRETE JOINTS INTERFACES UNDER REVERSED CYCLIC LOADING

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Abstract

Interface joints play an important role in the seismic response of masonry and concrete structures especially for large and unreinforced ones.. Despite their different origin, all these discontinuities can be generically characterized as "joint" to be modelled through a single generalized formulation, Puntel, Bolzon and Saouma (2006). Joint models abound in the literature and have reached levels of significant sophistication and maturity specially when examined through the prisms of fracture, plasticity or damage mechanics. However, most of them are inherently developed under the assumption of monotonic loading conditions thus disregarding specific features of reversed cyclic loading; in some cases this can lead to gross mistakes such as unsafe overestimation of joint opening. This deficiency is partly explained by the comparatively small number of test data and by the concurrent lack of experimentally derived relationships.

As such, this study addresses the scarcity in relevant tests. First, a complex experimental set-up is described and results reported of large scale tests on concrete joints subjected to constant compressive confinement and reverse cyclic shear load. After the analysis and discussion of the results, many evidences have prompted an interpretation based on a description of joint roughness as composed by two orders of asperities each with its own size and degradation properties. In view of these findings, an enhancement of the aforementioned generalized model previously developed by the authors has been motivated. Finally the numerical response of both the existing and the updated joint models has been compared with the experimental one. Thus the role of the proposed extension is clarified showing in particular the effectiveness of the asperity description in explaining at the same time both the shear strength and the dilatancy behaviour.

Keywords: reverse cyclic shear, experiment, concrete, roughness, earthquake engineering, joint interface model, dam engineering